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eggs are unknown, but it seems probable that we now know the principal types of eggs.

HARRISON G. DYAR.

U. S. NATIONAL MUSEUM,

October 1, 1902.

RECENT ZOOPALEONTOLOGY.

NEW VERTEBRATES OF THE MID-CRETACEOUS.

THE report just published on 'Vertebrata from the Mid-Cretaceous rocks of the Northwest Territory of Canada'* by Henry F. Osborn and Lawrence M. Lambe, forms the second part of a 'series of descriptive and illustrated quarto memoirs' begun in 1891. The first part, by the late Professor E. D. Cope, is on 'The Species from the Oligocene or Lower Miocene Beds of the Cypress Hills.'

The determination by the Canadian Survey of a Mid-Cretaceous and fresh-water fauna, including fishes, batrachians, reptiles and mammals, is a forward step of great importance in vertebrate paleontology. The Survey had established beyond question, geologically, that the Belly River series is Mid-Cretaceous, that it underlies the Montana or Ft. Pierre-Fox Hills group, and overlies the Ft. Benton and Dakota groups; and at the outset of the paleontological investigation for this report, the question arose, What stages of vertebrate evolution are represented by the Belly River fauna? It soon appeared to Professor Osborn in the study of the fine collection made by Mr. Lambe that the Belly River vertebrates of the Northwest Territory were of decidedly different and *apparently* of older type than those from the Laramie beds of Converse Co., Wyoming, described by Marsh, and were rather to be compared with those described by Leidy, Cope and Marsh, from Montana, chiefly from the Judith River beds, which

overlie the Ft. Pierre in a region by no means distant geographically.

The Belly River or Mid-Cretaceous fauna is distinguished from that of the Upper Jurassic (Como Beds, Purbeckien) by the entire absence of Sauropoda and by the presence of Ceratopsia in great variety. It is affiliated with that of the Jurassic, and, so far as we know, separated from that of the Laramie by the presence of highly specialized Stegosauria or plated dinosaurs,* by numerous turtles of the Jurassic family Pleurosternidæ, and by numerous large Plesiosaurs. There is very little in common between the Belly River fauna and the Laramie fauna of Wyoming and Colorado so far as described, except the dinosaur *Ornithomimus* and the very persistent chelonian *Baëna*. Most of the dinosaurs will probably be found to be separated generically.

A comparison between all the Belly River and Judith River or rather Montana and Laramie (Colorado and Wyoming) vertebrates, so far as named (111 species including many synonyms), leads to the conclusion: (1) that the Belly River fauna is more ancient in character both as to the older types of animals which it contains and as to the stages of evolution among animals which are also represented in the Laramie; (2) the geological interval represented by the Ft. Pierre-Fox Hills marine beds was accompanied by the extinction of certain Jurassic types and progressive evolution of the persistent types; (3) finally, the fossil land vertebrates hitherto described from Montana probably are, in part at least, of Mid-Cretaceous or Belly River age, although the true Judith River beds certainly overlie the Ft. Pierre and are of more recent age.

The descriptive section of the memoir by Mr. Lambe is illustrated by twenty-one plates and numerous text figures. The principal results are as follows:

Numerous vertebræ of a large plesiosaur from the Belly River are provisionally referred to the New Jersey species *Cimoliasaurus*

* 'Contributions to Canadian Paleontology,' Vol. III. (4to), Pt. II., 'Vertebrata of the Mid-Cretaceous of the Northwest Territory.' (1) 'Distinctive Characters of the Mid-Cretaceous Fauna,' by Henry Fairfield Osborn, Vertebrate Paleontologist (Honorary) of the Survey; (2) 'New Genera and Species from the Belly River Series (Mid-Cretaceous),' by Lawrence M. Lambe, Assistant Paleontologist. Ottawa, September, 1902.

* The only published evidence of Stegosauria in the Laramie of Wyoming and Colorado is the tooth of *Palæoscincus*.

magnus Leidy. From Moreau River, South Dakota, Leidy has described two plesiosaurs, *Nothosaurops occiduus* and *Ischyrosaurus antiquus*; whether these animals are of Belly River age or more recent is not known.

Turtles of the suborder *Trionychia* are abundant. One species, *Trionyx foveatus*, is common to the Judith and Belly River series; another, *T. vagans*, to the Belly River and supposed 'Ft. Union' beds. The order Cryptodira is represented in the Cretaceous by large swamp turtles related to the Dermatemydidæ, but belonging to the family Adocidæ; these are *Adocus lineolatus* Cope, *A. (Basilemys, or 'royal turtle,' Hay) variolosus* and *A. (Basilemys) imbricarius*; the royal turtle is very large and elaborately sculptured. It is important to note that the two species first named are found both in the Belly River and in Montana (? 'Ft. Union'), testifying to the Mid-Cretaceous age of the latter. The presence of numerous species of the Jurassic family Pleurosternidæ (order Pleurodira or Amphichelydia) is another distinctly ancient feature of this fauna; two of these, *Compsemys victus* and *C. obscurus* Leidy, are described from Montana. A third member of the same family, *Baëna hatcheri*, is noteworthy as the only species of vertebrate thus far recorded which is common to both the Belly River and Laramie. A fourth new species, *B. antiqua*, is described from the Belly River. *Polythorax missouriensis* from Montana is also referred by Hay to the Pleurosternidæ. Mr. Lambe proposes the new genus and species, *Neurankylus eximius*, a new chelydroid turtle, distinguished by a supernumerary costal.

Belonging to the rhynchocephalia, *Champsosaurus*, according to Cope is represented by five species of the Judith River, one of which, *C. annectens*, is also determined in the Belly River. As Cope has identified this genus in the basal Eocene, it is not distinctive as to age.

The sculptured tooth named *Troödon formosus* by Leidy is common to the Belly River and Judith River beds; it is uncertain whether this is a lizard or a stegosaur, probably the former. *Palæoscincus costatus* Leidy is also common to the Judith and Belly River

series. A clearly distinct species is *P. asper* Lambe from the Belly River.

The species *Crocodylus humilis* of the Judith River is provisionally identified by Mr. Lambe in the Belly River. These beds also contain another Montana crocodile, *Bottosaurus perrugosus*, Cope.

Passing to the dinosaurs, as stated above, the presence of Stegosauria is an ancient characteristic. From the 'Middle Cretaceous of Wyoming,' Marsh determined the Stegosaur *Nodosaurus* ('The Dinosaurs of North America,' p. 225). Probably allied to this or to the *Polacanthus* of the English Wealden, is the remarkable new animal, *Stereocephalus tutus*, in the Belly River series, with solid skull armature and a ring of postcranial, pointed ossicles.

The carnivorous dinosaurs and the collateral families will probably be greatly elucidated by the separation of the Mid- from the Upper Cretaceous types. Among the former the genera *Deinodon* and *Aublysodon* Leidy and *Ornithomimus* Marsh, all Montana types, deserve first mention. After Marsh had substituted the name *Dryptosaurus* for the preoccupied name *Laelaps* (which Cope had employed for an Upper Cretaceous of New Jersey carnivore) it was generally supposed that all large Cretaceous carnivores should be referred to Marsh's genus. If, however, the large Judith River type, which has its counterpart in the Belly River, is older than the true Laramie type, it is in all probability generically distinct and Leidy's name *Deinodon* should be applied to it.* This name was securely founded on megalosaurian teeth, and those first mentioned in both Leidy's descriptions and first figured in his memoir on the Judith River vertebrates must be regarded as valid types irrespective of the following facts: (1) that Leidy expressed some uncertainty as to his separation of *Deinodon* from the English Jurassic genus *Megalosaurus*; (2) that he associated with the types a number of large serrate incisor teeth, truncate posteriorly, which probably belong with *Deinodon*; (3) also smaller non-serrate

* Dr. O. P. Hay (*Amer. Geologist*, XXIV., 1899, p. 346) is of the opinion that Cope was justified in rejecting the name *Deinodon*.

teeth truncate posteriorly, which certainly do not belong with *Deinodon*; (4) that he subsequently selected the two latter (2 and 3) as the types of *Aublysodon*. The Cretaceous carnivorous dinosaur of the Judith River beds should, therefore, be named *Deinodon*. Belonging to this is the type species *D. horridus* Leidy; probably also the species *D. cristatus* Cope and *D. lævifrons* Cope, from Montana. To *Dryptosaurus*, on the other hand, may well belong the large Upper Cretaceous carnivore *D. incrassatus* Cope, from the Edmonton series of Alberta.

The discovery of additional remains of *Ornithomimus* in the Belly River series, as represented by a large new species, is of great interest. Mr. Hatcher states that he found Marsh's type of this genus, consisting of a foot and a portion of a limb, on Cow Island, Missouri River, at a level which he estimates from 1,500 to 1,600 feet below the summit of the Judith River beds, and 500 to 600 feet below the level of Marsh's type of *Ceratops montanus*.

Ornithomimus altus is probably a successor of a comparatively small and lightly built dinosaur recently discovered by the American Museum parties in the Como Beds of Wyoming.* *Ornithomimus* is more progressive than its supposed ancestor, in the development of cursorial rather than prehensile phalanges in the pes, these elements having nearly lost the recurved megalosauroid structure.

One of the distinguishing features of the Belly River fauna is the great number and variety of the Iguanodonts. The separation of Mid- from Upper Cretaceous iguanodonts, will, if confirmed by closer examination and determination of geological horizons and levels, greatly increase our understanding of this most interesting group. Without professing to have made an adequate investigation, Professor Osborn is strongly of the opinion that the Cretaceous includes a number of distinct genera, representing a wide adaptive radiation and probably a number of successive phyla. The wide differences in the mode of succession, general shape and border sculpturing of the

teeth, indicate profound changes which required an enormous period of time for their development. There are also indications of a separation of the Iguanodonts into light- and heavy-limbed series, smaller and larger, swifter and clumsier, of great variety in tooth structure.

In the Belly River series we find the new species *Trachodon selwyni* Lambe, an animal nearly double the size of the *Iguanodon mantelli* of the English Wealdon (Upper Jurassic). A more delicately built iguanodont *P. marginatus* Lambe resembles the less robust iguanodont *Pteropelyx grallipes* Cope, but is specifically distinct in the border sculpture of the teeth. A third new species, or even genus *P. (Didanodon) altidens* Lambe, is distinguished by exceptionally high narrow teeth.

In the order Ceratopsia, perhaps more than in any other, the resemblance between the Belly River and Montana stages and the contrast between these and the Wyoming Laramie stages, so far as known, are distinctly marked. In general the contrast in the Ceratopsia is as follows: Belly and Judith River Ceratopsia, of smaller size; nasal horns very large; small frontal or supraorbital horns; widely open supratemporal fossæ; teeth single (? *Monoclonius*) and double fanged. Laramie Upper Cretaceous, Ceratopsia, of larger size; nasal horns relatively smaller (*Triceratops*) or even vestigial; greatly developed frontal horns; supratemporal fossæ open (*Torosaurus*) or nearly closed (*Triceratops*).

Monoclonius Cope is the first name applied to a Montana ceratopsid. The apparently new species, *M. dawsoni*, *M. canadensis* and *M. belli*, discovered by Mr. Lambe in the Belly River series, add to the variations in the *Monoclonius* type of skull in the Mid-Cretaceous. It will be observed that all of these species are known to possess large nasal and small supraorbital horns. This stage of horn evolution may be contemporaneous with and independent of that in the southern Laramie dinosaurs, in which the nasal horns are invariably smaller than the frontal horns, but coupled with the smaller size and open temporal fossæ, it would appear to be more primitive. The new genus *Stegoceras*, proposed in

* It will shortly be described in a bulletin of the American Museum.

this memoir, may represent a type with small nasal horns, as in some of the Laramie Ceratopsids, such as *Sterrholophus*.

It is not at all improbable that the horned dinosaurs will prove to be diphyletic, one line with persistent open fossæ leading from *Monoclonius* to *Torosaurus*, the other leading to *Triceratops* with closed fossæ.

Of the two mammals discovered in the Belly River, *Ptilodus primævus*, judging by the condition of the grooves upon its premolars and tubercles upon its molar teeth, is undoubtedly more primitive than the Laramie plagiaulacids.

H. F. O.

INSTRUCTION OFFERED IN THE FISHERY COMMISSION LABORATORY AT BERGEN.

A NOVEL departure on the part of Fishery Commission authorities is announced in Norway. The scientists of the Norwegian Board of Fisheries in Bergen have arranged for the opening of a winter school of biology to be held in the laboratory in Bergen beginning January 12, 1903, and ending April 1. The course will be offered freely to students of all countries, and there can be little doubt, judging from the rich results that the Norwegian research steamer 'Michael Sars' has been gathering, that such an opportunity for marine studies will be of the greatest value. Dr. Johan Hjort, the director of the station, will have charge of matters relating to fishes—biology, spawning habits, growth and migration—and fisheries, and in connection with this work will give instruction in the practical side of oceanic investigation on board of the 'Michael Sars.' Dr. B. Helland-Hansen is to give a course in hydrography, chemical and physical, Dr. H. H. Gran in planktology, and Dr. A. Appelloef in the zoology of invertebrates and in geographical distribution. The development of this laboratory, it may be noted, is a logical outcome of the recent work which the Norwegian investigators have been carrying on in connection with the Fishery Commission. And if it bears the fruit which such an undertaking deserves, there can be little doubt that the Norwegian station will become an important adjunct to the university training of many of the younger

men, in both Europe and America. One fears, however, that a Norwegian winter will prove an unfavorable season for the popularity of this work, and we may hope that a summer course on similar lines will later be arranged.

B. D.

THE BUREAU OF ETHNOLOGY.*

PROFESSOR W. H. HOLMES, curator for anthropology of the National Museum, was formally appointed director [the title has been altered to 'chief'] of the bureau of ethnology by S. P. Langley, secretary of the Smithsonian Institution. This announcement caused inexpressible disappointment among the associates of Professor W. J. McGee, ethnologist in charge of the bureau, whose appointment had been looked for daily since the death of John W. Powell, formerly director of the bureau of ethnology, on September 23. Secretary Langley said to a reporter of the *Times* that it would be more decorous for Professor Holmes or Professor McGee to speak of the installation of the new director than for him to remark upon it. Neither one of these men had anything to say more than that the less said about it the better. It is the opinion of scientists that Professor Holmes did not seek the appointment. He is interested and contented in his scientific duties at the National Museum, and so much so that he will in all likelihood continue in that office, where he has gained the reputation of being one of the foremost anthropologists in America, in addition to performing the new work which he has been selected to do. Assigning and appointing scientists in the national scientific institutions lies wholly within the discretion of the secretary of the Smithsonian Institution by virtue of its regulations and custom.

Professor McGee was informed of the secretary's choice over the telephone shortly after three o'clock in the afternoon. Secretary Langley said that he would drive to the bureau of ethnology with Professor Holmes and introduce him to Professor McGee and his little coterie of workers and friends. Depressed feelings were noticeable immediately

* From the *Washington Times*.